

PLUNKETT'S CREEK BRIDGE NO.3
Spanning Plunkett's Creek on State Route 1005
Barbours Vicinity
Lycoming County
Pennsylvania

HAER No. PA-418

HAER
PA
41-BARB.V
1-

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
National Park Service
Philadelphia Support Office
U.S. Custom House
200 Chestnut Street
Philadelphia, PA 19106

HISTORIC AMERICAN ENGINEERING RECORD

PLUNKETT'S CREEK BRIDGE, No. 3

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Location:

Spanning Plunkett's Creek on
State Route 1005, Barbours
vicinity
Lycoming County, Pennsylvania
U.S.G.S. Barbours Quadrangle,
Universal Transverse Mercator
Coordinates:
18.349253.4585499

Date of Construction:

c. 1840-1875

Present Owner:

Pennsylvania Department of
Transportation

Present Use:

N/A (Demolished)

Significance:

Plunkett's Creek Bridge No. 3
was constructed around the
middle of the nineteenth cen-
tury to carry traffic between
Proctor and Barbours, Pennsyl-
vania. The bridge was a sin-
gle span, rubble masonry arch
structure with a roughly
crenelated parapet. Plun-
kett's Creek Bridge No. 3 was
significant as an intact exam-
ple of middle nineteenth cen-
tury stone arch bridge con-
struction.

Project Information Statement:

This documentation package was
prepared as mitigation for the
emergency demolition of the
Plunkett's Creek Bridge No. 3.
The bridge was critically
damaged as a result of record
flooding along Plunkett's
Creek in January 1996.

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2601 North Front Street
Harrisburg, Pennsylvania 17110
August 1996

Plunkett's Creek Bridge No. 3 was built between 1840 and 1875 to carry traffic over Plunkett's Creek between Barbours and Proctor, Lycoming County, Pennsylvania (see Project Location Map). The bridge was a single span, one-lane stone arch structure with a roughly crenelated parapet. Located in a mountainous area of Lycoming County, Plunkett's Creek Township was the site of numerous timber companies, sawmills, a tannery, and coal mining operations in the nineteenth century. Plunkett's Creek Bridge was representative of stone arch bridge technology and the history of Lycoming County.

A. History of Lycoming County and Plunkett's Creek Township

Lycoming County was formed in 1795 from Northumberland County. Crossed by the West Branch of the Susquehanna River, the county is characterized by mountains running in a southwesterly-northeasterly direction, numerous creeks and runs draining into the Susquehanna River, and fertile valleys. In addition to agricultural products, the economy of Lycoming County, beginning at the time of its formation, has been characterized by exploitation of its lumber, coal, and iron ore. Early settlements occurred at Williamsport, Jersey Shore, and Muncy. In addition to its proximity to the Susquehanna River and Loyalsock and Lycoming Creeks, which were important routes for transporting agricultural products and timber, Lycoming County was also strategically located along the route of the State Road which eventually traversed lands along the Susquehanna from Harrisburg northward to the New York State line and the Genessee Valley towns of Elmira and Painted Post, New York. The section of the State Road which runs through Lycoming County from Newberry to the State line was authorized by the Pennsylvania legislature in 1799 and was completed by early 1800 at a cost of \$3,000 (Meginness 1892:315-6).

Plunkett's Creek Township is located at the northeastern corner of Lycoming County near the Sullivan County border and has been described by county and township historians as "extremely wild and mountainous" (Meginness 1892:624 and Lloyd 1929:210). Indeed, the township is marked from its northern boundary to its southern boundary by Popple Ridge, Cove Mountain, Camp Mountain, Rough Hill, and Rock Ridge. The rugged terrain was doubtless a factor in petitioning of some of the residents of Davidson (now in Sullivan County) and Franklin Townships for a new township in December 1836. Prior to the formation of Plunkett's Creek Township, these residents had to travel twelve to sixteen miles over mountainous terrain to attend elections and other official business.

Plunkett's Creek Township was named for Colonel William Plunkett, a physician who attended to the earliest settlers along the

Loyalsock Creek during the Indian Wars. His service was noted by the grant of six tracts of land totaling just under 2,000 acres in 1776. Despite his rank and service, Plunkett was thought by subsequent settlers to be disloyal during the American Revolution. Plunkett is not known to have settled on the lands along the creek which bears his name, and he died in Sunbury, Northumberland County, in 1791 at the age of 100.

First settlement in Plunkett's Creek Township occurred between 1770 and 1776, but it was not until the early 1800's that significant numbers of settlers established residence in the township. One early settler, John Barbour, established a lumber mill on the Loyalsock Creek between the mouths of Plunkett's and Big Bear Creeks in 1832. Barbour Mills, as the settlement came to be known, consisted of a store, school, blacksmith shop, hotel, and several residences; a post office was established in 1839. John Barbour served as postmaster from 1839 until 1862 (Meginness 1892:626).

Another settlement was established along Plunkett's Creek near the confluence of the creek with King Run, north of Barbours Mills. Proctor(ville) was named for Thomas E. Proctor who built a tannery at the site in 1868. This community also consisted of two stores, two blacksmith shops, and a wagon shop in addition to numerous residences. Proctor's tannery was an extensive operation with two bank mills, a sweat house, dry houses, 300 vats, and an engine house and machinery. In addition to the men employed at the tannery site, as many as several hundred men were employed as lumbermen to supply the operation with timber. The Proctor tannery was one of the largest in the state when it was completed in 1873. Proctor also operated a large store at Proctorville. (Stewart 1876:73 and Meginness 1892:626.)

The forests of Plunkett's Creek Township were heavily lumbered in the nineteenth and early twentieth centuries. The 1861 atlas of the township depicts fourteen mills along Plunkett's Creek, Loyalsock Creek, and Big Bear Run. By 1876, there were nineteen saw mills in addition to a specialized lumber and shingle mill, a woolen factory, two blacksmith shops, and Thomas Proctor's tannery within the boundaries of the township (Beach 1873). These saw mills and other related industries employed many; the 1890 census lists 777 inhabitants in the township (Meginness 1892:625). The intensity with which the timber was harvested caused the supply to become depleted at the beginning of the twentieth century. In 1920, the township's population had dwindled to 330 (Lloyd 1929:211).

The area's natural resources also attracted sport fishermen. The earliest fishing clubs in the township were located along Big Bear

and West Bear Creeks in the late 1880's. The streams were dammed at the fishing club site, and cottages were provided to the members during the summer season.

In 1919, the Pennsylvania State Game Commission was authorized by the legislature to purchase lands for game refuges and public hunting grounds; the first State Game Lands were purchased the following year (Kosak 1995:220-1). State Game Lands No. 134, which comprise Camp Mountain on the east of the road between Proctor and Barbours and Cove Mountain on the west, were purchased between 1937 and 1945 (Hoover, personal communication). In the spring of 1945, a 1,200-acre State wild turkey farm in Juniata County was moved to a 1,400-acre site in Lycoming County. This site is located within State Game Lands No. 134, west of Plunkett's Creek and north of Loyalsock Creek.

B. History of Plunkett's Creek Bridge No. 3

The development of the road network in Plunkett's Creek Township began shortly after the settlement of the area but was limited by the mountainous terrain. Most of the roads were laid out along the banks of the creeks in the valleys of the township. These valleys were also where the overwhelming majority of settlement occurred. In 1840, a road was laid out from Barbours Mills northward along Plunkett's Creek, to the site of Proctor, and eastward to Hills-grove (Proctor had not yet been founded) (Lycoming County Road Docket 3:55-7) (see Resource Location Map). The road docket entry for the 1840 road does not reference the construction of bridges by the county or the necessity of fording Plunkett's Creek.

Although the road docket recording the layout of the road between Proctor and Barbours does not specifically mention bridges over the four crossings over Plunkett's Creek, other evidence suggests that four bridges were built around the time that the road was established. The 1861 and 1876 atlases of Lycoming County depict four crossings at the approximate locations of the current crossings (n.a. 1861 and Nichols 1876). The third crossing of the road over Plunkett's Creek, in the vicinity of lands of a J. Weaver and William Storrs, is in the location of Plunkett's Creek Bridge No. 3.

Road and bridge dockets and order books available at the Lycoming County Courthouse do not refer to the construction of the initial bridges over Plunkett's Creek.¹ Petitions and orders concerning

¹ According to the Lycoming County Planning Office, when the new Lycoming County Courthouse was completed in the

the road and bridges from Proctor to Barbours in the second half of the nineteenth century refer to the first, second, third, and fourth bridges (traveling from Barbours to the south to Proctor on the north) over the creek (Lycoming County Road Docket Books). The road between the second and third bridge was viewed for relocation in 1875; the sketch of the realignment is included in the docket book and shows a bridge in the location of Plunkett's Creek Bridge No. 3 (Lycoming County Road Docket Book 7:562-4). The road from the second to the third bridges was returned to its original location on the west side of the creek in 1886 (Lycoming County Road Docket Book 8:515-6).

The first and second bridges over Plunkett's Creek were replaced in the 1880's. A petition and viewing for a covered bridge to replace the existing bridge over Plunkett's Creek at Barbours was conducted in 1880 (Lycoming County Road Docket Book 8:270-1). A viewing to replace the second bridge over Plunkett's Creek at county expense was conducted in 1886; the report of the viewers recommended that the county not pay for the bridge but give the township \$400.00 to be applied to the cost of construction (Lycoming County Road Docket Book 8:524-5).

In 1918, excessive rains caused damage to the township road from 100 feet upstream of Plunkett's Creek Bridge to 100 feet downstream of the bridge and settling and cracking of the bridge itself. The viewers recommended repairs and reconstruction to the "old stone arch bridge" and its abutments (Lycoming County Road Docket Book 10:380-2).

The available records indicate that Plunkett's Creek Bridge No. 3 was constructed after 1840, when the road between Barbours and Proctor was laid out, and before 1875, when the road was realigned.

In 1932, the road of which Plunkett's Creek Bridge No. 3 is a part, which had been maintained by the township with assistance from Lycoming County, was adopted by the State according to an Act of the legislature passed in 1931 (Law of the Commonwealth of Pennsylvania No. 203, Session of 1931:343). This Act relieved townships and municipalities of the cost of maintenance of local roads and bridges.

early 1970's, many records, including those of the county engineer's office, were destroyed. Contacts with Plunkett's Creek Township supervisors revealed that the historical records of the township have not been retained.

C. Plunkett's Creek Bridge No. 3 and Stone Arch Bridge Technology

Plunkett's Creek Bridge No. 3 was a single-span, rubble masonry arch bridge with a low, semi-circular arch opening (see Schematic Elevation and Plan). The bridge spanned Plunkett's Creek and was forty-four feet long with a roadway width of fifteen feet, three inches. The bridge deck width was eighteen feet, eight inches. The structure had stone riprap wing walls with a concrete-jacketed abutments. The voussoirs of the arch were irregular rubble stone, and there was no keystone. The parapets were characterized by rough, crenellated stones. Plunkett's Creek Bridge No. 3 was collapsed in March 1996 following record flooding along Plunkett's Creek. The photographs attached to this report depict the bridge in its damaged conditions (Photograph Nos. 1 through 6).

The tradition of constructing stone arch bridges is long established in Pennsylvania. Although historians of technology note that very little data exist for stone arches of the seventeenth or eighteenth centuries, the oldest known stone arch bridge in the United States which still carries a modern highway is found in Pennsylvania. This bridge, the Frankford Avenue Bridge which crosses Pennypack Creek in Philadelphia, was constructed in 1697 as part of the King's Road.² Late eighteenth century and nineteenth century stone arch bridges continue to carry vehicular traffic in Pennsylvania; these bridges were built as part of the network of public roads and turnpikes which moved people and their products across the Commonwealth. The tradition for building stone highway bridges in Pennsylvania continued well into the twentieth century. The style of these later stone arch bridges often imitates that of the eighteenth and nineteenth century bridges.

Geographic concentrations of stone arch bridges exist in Pennsylvania. Sandstone, limestone, gneiss, and marble are all available in central and eastern Pennsylvania. The concentration of stone arch bridges responds to this distribution. Masonry bridges are located primarily in the southeastern and southcentral portions of the State; a few are located in the western counties.

The components of a typical single span stone arch bridge include spandrel walls, arch barrel, roadway parapet, and abutments. The spandrel walls serve as the retaining walls for the fill material (usually stones, large rocks, and soil) on either side. The arch

² The King's Road, the earliest inter-city commerce route, was built at the behest of William Penn, founder, planner, and developer of Pennsylvania's initial cities and roadways.

barrel and roadway surround the fill material on the bottom and top, respectively. The parapet is an extension of the spandrel wall and is the outermost edge of the roadway. On stone arch bridges, parapets are usually solid and unembellished, although some are designed with ornamental features such as the roughly crenelated parapet of Plunkett's Creek Bridge No. 3.

Other decorative features which may be found on a stone arch bridge are a belt course, dressed voussoirs, keystone, and date stone. The belt course is a horizontal band of masonry which usually extends across the spandrel wall and may be flush with or projecting from the wall. The voussoirs are the wedge-shaped stones which create the arch ring; the center voussoir is called the keystone. The date stone is usually found in the parapet on the cartway side and is inscribed with the date of construction and may contain other information such as the builder's name, the name of the bridge, and any public officials involved. Plunkett's Creek Bridge No. 3 does not have an inscribed date stone.

Stone masonry can be differentiated by the type of material used, the method of finishing the stone surfaces, and the method of bridge construction. As previously discussed, the type of material used could be sandstone, limestone, gneiss, and marble but could also include brick, granite, and other building stone.

Three broad categories can be used to describe the method of finishing the stone surfaces. The first category is rubble masonry consisting of rough stones which are unsquared and used as they come from the quarry. Plunkett's Creek Bridge No. 3 is an example of rubble masonry. The second category, squared-stone masonry, consists of stones which are squared and dressed roughly. The third category, ashlar, consists of stones which are precisely squared and finely dressed. The facing of finely dressed stone can be worked to produce a variety of finishes, depending on the tools used.

Standard engineering specifications existed for ashlar (first class masonry), squared-stone masonry (second class masonry), and rubble construction (third class masonry). Rubble masonry could be constructed to approximate regular rows or courses (coursed rubble) or could be uncoursed (random rubble). Random rubble was the least expensive type of stone masonry construction but was considered strong and durable for small spans if well executed. Ashlar and squared stone could be laid randomly or in courses. Single span and multiple span stone arches were built of both rubble and ashlar construction in Pennsylvania, although most of the earliest stone arches associated with highways, such as Plunkett's Creek Bridge No. 3, were constructed of rubble masonry.

Stone arches also vary in their geometric shape. The arch could conform to numerous curves, the most common being semi-circular, and segmental. Other shapes were elliptical and multi-centered curves. The arch barrel could be built "right" so that the spandrel wall and longitudinal axis of the bridge are perpendicular; the barrel alternatively could be built "skew" such that the spandrel wall would be built at an angle oblique to the axis of the bridge.

The shapes represented by Pennsylvania stone arches are varied. Bridges are most commonly built "right" to minimize their span length and therefore the bridge costs. However, there are some skew arch bridges in Pennsylvania.

By the late 1800s, theoretical knowledge abounded in the approach to arch design, standardized nomenclature was established, and design specifications were published. In 1877, recommended specifications were published in the Transactions of the American Society of Civil Engineers. Still, the design of masonry arches was always interpreted by the experience of the engineer, designer, or contractor. Authorities noted the need for continued research and acknowledged that there could be no exact scientific approach to masonry arch analysis because of its inherent indeterminate nature. Many variations were possible in the material used, the workmanship in dressing and bedding the stone, the bond and strength of the mortar, the construction method used, and the effect of foundation settlement.

Thus, the success of masonry arch bridges depended equally on correct design and careful craftsmanship. Common precautions demanded laying the stone on its bedding plane to ensure durability, but there was little reliable scientific knowledge on the predictable performance of the durability of stone. That the material itself was subject to deterioration was understood. An 1896 text on masonry construction noted that stone deterioration was accomplished by mechanical means (frost, wind, fire, pressure, and friction), chemical means (atmospheric acids), and organic means (mineral decomposition of stone). However, it was not possible to predict the durability of a particular stone because variable climates produced a range of effects. The principal factors understood to control the durability of stone as a construction material were its proper seasoning prior to use and the proper laying of the stone.

Three general rules were to be followed in stone masonry construction. First, the stones were to be laid so that the courses were perpendicular to the pressure exerted by the loads above. In addition, the mortar joints were to be staggered to avoid long,

continuous joints parallel to the pressure exerted by vehicles. Second, the largest stones were to be used in the foundation. Third, stratified stones were to be laid so that pressure was exerted perpendicular to the strata of the stone; this was termed "laying the stone on its natural bed".

Care was also taken to ensure good mortar bond and strength. Dry, porous stones needed to be moistened well to avoid drying the mortar and reducing it to powder. Joints were to be well packed and as small as possible. Ira O. Baker stressed in his 1899 Treatise on Masonry Construction that "the principal object of the mortar is to equalize the pressure" and "the rougher the stones, the better the mortar should be".

To assure a solid structure, it was recommended that the stones be fitted into place dry so the stone cutter could correct the fit before the stone was laid in mortar. Recommended joint thickness varied with the quality of mortar: from one-eighth inch for the very best ashlar masonry to one-half inch for first class masonry used for railroad bridges.

The actual construction of the bridges began with excavation for the foundations. For single span bridges, foundations and abutments were built first, while multiple span bridges incorporated piers in the first phase of construction. Often, the foundations consisted of timber grillage on piling. Once the abutments and, in the case of multiple span bridges, the piers were constructed, the arch or arches could be built.

Constructing the arch from abutment to abutment required a temporary structure which would support the stones until completed. This temporary structure, called a center or centering, was usually built of wood but sometimes was made of rolled iron. Generally, the center was made of ribs spanned by narrow planks (laggings) which supported the arch stones. The ends of the ribs could rest on the abutment or they could be carried by timber trusses and struts. The exact configuration of the center was determined by the span and shape of the arch. The framing and set up of the center was extremely important for the stability of the arch; a weak, shifting, or sagging center could change the shape of the arch and, if drastic, make the arch unsafe.

Once the center was in place, the arch was constructed and the spandrel wall and filling were placed. The space from the arch itself to the roadway was ordinarily filled with earth and broken stones. Sometimes, to lighten the load, a series of longitudinal and transverse arches was built inside the filling space and the top few feet consisted of fill material. The interior of the

arches was waterproofed by application of a layer of cement mortar, coal tar, or asphalt. A drainage system was sometimes constructed to discharge infiltrating water over the piers and abutments.

Finally when the arch was completed, the temporary support was removed. The proper time and method for the removal, or striking, of the centers was crucial. After allowing the mortar appropriate time for hardening, the center could be safely removed, but often it was left in place for months for arch bridges. The construction of the center allowed for gradual, uniform lowering.

SOURCES OF INFORMATION

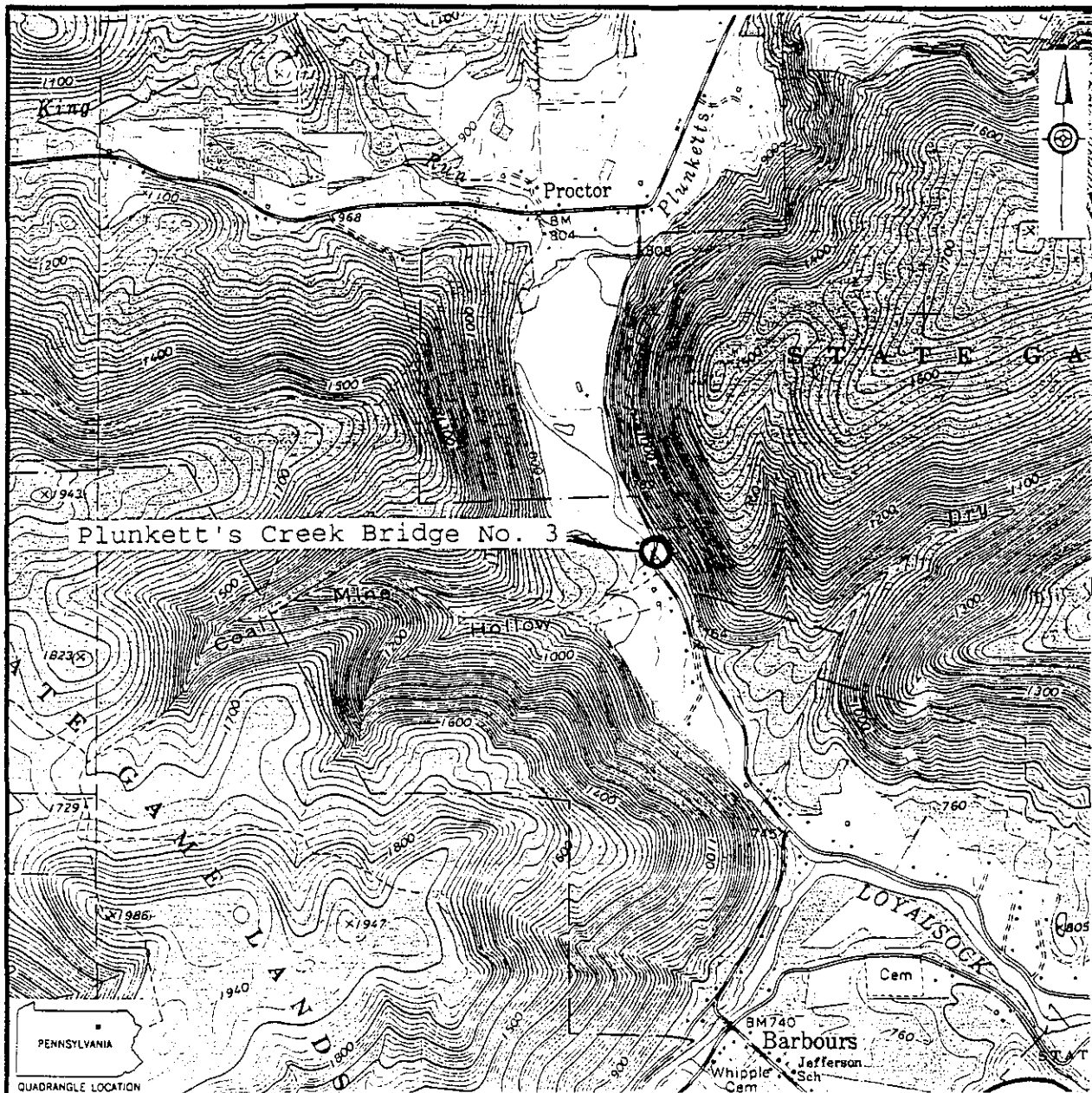
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Plunkett's Creek Bridge No. 3
S.R. 1005, Section 010
Plunkett's Creek Township
Lycoming County, Pennsylvania

Resource Location Map

Source: U.S.G.S. Barbours, Pennsylvania, Quadrangle

Scale: 1"=2,000'